providing food for the female. But the reason why there is apparently not the least increase in the number of females remains to be shown.

A different problem seems to be presented by the conditions found on St. Paul, thirty miles distant from St. George.

On St. Paul efforts were made by Mr. Judge last winter to localize the foxes by exposing seal carcasses as food in the stable at Northeast Point and at the watch-house at Half-way Point. His efforts, however, were not successful in bringing together foxes in any number sufficient to justify the adoption of the trapping methods used on St. George. The old method of trapping with steel traps, therefore, was resorted to, the killing being restricted to about two weeks' actual trapping. This catch amounted to 153 blues and 1 white.

The trapping on St. Paul disclosed the presence of about a dozen pelts of very inferior quality. Nearly all of these skins were taken on the reef adjacent to the village. This ground has always rendered a poor grade of skins, but this year the belief is that those skins are poorer than ever before.

So far no means have been arrived at which will assure the perpetuation of the species on St. Paul Island. In former years it was the practice to take foxes only on alternate years on St. Paul Island, the intervening year being closed to trapping. The numbers still decreasing, it was thought wise during the last two seasons to trap during a limited time each season, proceeding on the theory that, owing to the fewer number of seals taken, the food supply on the island was insufficient to provide for a larger number of foxes, and that it was better to trap the surplus than to allow it to die of starvation.

The food supply on the island last winter, however, was more than was necessary to support the fox herd, owing to the large number of dead arries cast up on its shores. The carcasses of these birds, Agent Judge states, were found in numbers uneaten the following spring. This unusual food supply undoubtedly served to defeat the efforts made to localize the foxes by artificial feeding, and to trap them in house traps. It may be, if these efforts are continued the winter of 1901–02, that better results will follow, but, unless some improved method of fox trapping or fox culture is devised for St. Paul, the practical extermination of the species on that island is threatened.

Walter I. Lembkey,
F. A. Lucas.

SCIENTIFIC BOOKS.

RECENT BOOKS ON HYGIENE.

Principles of Sanitary Science and the Public Health. By William T. Sedgwick, Ph.D. 1st edition. New York, The Macmillan Company. 1902. 8mo. Pp. 368. Price, $3.00.

Water Supply (considered principally from a sanitary standpoint). By William P. Mason. 3d edition. New York, John Wiley & Sons. Pp. 448.

Bacteriological Examination of Water. By W. H. Horrocks, M.B.B.Sc., London, Assistant Professor of Military Hygiene in the Army Medical School, Netley. London, J. & A. Churchill; Philadelphia, P. Blakiston's Son & Co. 1901. Pp. 300.

Municipal Engineering and Sanitation. By M. M. Baker, Ph.B., C.E., Associate Editor of *Engineering News.* 1st edition. New York, The Macmillan Company. 1902. The Citizen's Library. 12mo. Pp. 318. Price, $1.25.

Sewage and the Bacterial Purification of Sewage. By Samuel Rideal, D.Sc. (London). New York, John Wiley & Sons. 1901. 8vo. Pp. 316. Price, $3.50.

Whatever Professor Sedgwick may write will always be read with pleasure and profit,

and his recent volume on the 'Principles of Sanitary Science and Public Health,' with special reference to the causation and prevention of infectious diseases, will be received with intense satisfaction by students of this subject. He has been the biologist to the State Board of Health of Massachusetts and also professor of sanitary science and the public health in the Massachusetts Institute of Technology for a number of years, and his opinions are, therefore, entitled to great weight. His work is as clear and accurate as his lectures, and it is well for mankind that his teachings are now accessible to a larger number of students, especially as we thoroughly endorse his quotation from Lord Derby that 'sanitary instruction is even more important than sanitary legislation.' The work is divided in three parts. Part I. deals with 'Health and Disease'; Chapter 1, on health, old age and disease—a classification of diseases according to their place of origin; Chapter 2, on the causes of disease, ancient and modern theories; the zymotic or germ theory of infectious disease; Chapter 3, on the rise and influence of bacteriology; transformation of the zymotic into the zymotoxic theory of infectious disease; and Chapter 4, on the sanitary aspects of the struggle for existence; parasitism, health and disease in terms of general biology, vital resistance, susceptibility and immunity. These chapters are written in a masterly style and are pregnant with facts clearly and concisely presented. We are pleased that among the theories of the eighteenth century regarding the causes of disease, Hahnemann's pretensions receive attention in a quotation from the 'Encyclopædia Britannica,' 9th edition, Vol. XII., pp. 126–129: "Hahnemann taught that disease is to be regarded as consisting especially of the symptoms of it as experienced and expressed by the patient or as detected by the physician; in other words that the chief symptoms or the 'totality of the symptoms' constitute the disease, and that disease is in no case caused by any material substance, but is only and always a peculiar, virtual, dynamic derangement of the health. "Diseases (introduction to the 'Organon,' p. 17) will not cease to be spiritual dynamic derangements of our spiritual vital principle." In all countries the doctrine of homeopathy is still without broad scientific recognition. * * * Modern medicine is doing some of its best work in showing the material and the visible character of the causes of many of the commonest diseases and suggests this in many cases where it has not yet been demonstrated. The cause of many diseases is shown to be a living germ, or particle, which can be discerned under the microscope, can be carried on a lancet or in a tube and inserted under the skin so as to produce its peculiar disease. * * * The causes of other diseases are often not merely visible under the microscope, but coarsely visible. * * * The lead which paralyzes the painter's wrist is not a 'spiritual' thing. It is an accumulation of matter in the wrong place and enters his body in palpable quantities, and, what is more, can be recovered in similar quantities from his body. So with uric acid or its salts in the blood of a person who has inherited his father's gout, and perhaps his port wine. It is not a 'spiritual' affair at all, but can be demonstrated chemically and under the microscope. The itch to whose mysterious workings Hahnemann attributed two thirds of the internal diseases of the body, including mania, cancer, gout, etc., is easily demonstrated to be dependent on an ugly crab-like insect, which can be destroyed in a few hours with sulphur, when there is an end both of it and of the itch." In spite of the rotten foundation of Hahnemann's teachings, a monument has been erected to him which occupies one of the most conspicuous sites in the national capital.

We like our author's paragraph wherein he says: "If diseases due to defects or flaws in the vital machinery are to be avoided, this is obviously to be done only by improving and perfecting the apparatus, which is a comparatively slow and difficult matter. To make a family of weak constitution strong is to reconstitute its entire physical basis, and if this can be done at all, it may be only after generations shall have come and gone. It must be done by careful living and good feeding, wise intermarriage and severe natural selec-

tion. Sanitation alone cannot hope to effect these changes. Diseases which arise from some invasion of the organism may possibly be warded off. As they virtually proceed from the environment which, in theory at least, is under our control, they may be prevented. With such diseases the sanitary science of to-day is chiefly concerned.

"Sanitation has stamped out smallpox in many civilized communities. It is seeking to-day with more or less success to do away with typhoid fever. It boldly attacks epidemics of diphtheria and scarlet fever and has recently sought to control tuberculosis and malaria. There can be no question that it has already won signal victories, and that its practitioners may reasonably hope for fresh laurels in the near future."

As a matter of fact the achievements of sanitation have been modestly stated, when we consider that the mortality from typhoid fever, diarrhœal diseases and consumption has been reduced during the fifty years fully one half, and that the reduction in the mortality from croup and diphtheria in the United States during the past ten years alone amounts to over 52 per cent. Indeed when the methods of prevention recommended by sanitarians are generally adopted many of these diseases will be reduced to a minimum and probably eradicated in the course of a few years. So, for example, in December, 1900, the propagation of yellow fever by mosquitoes was discovered by Surgeon Walter Reed and his colaborers of the United States Army, and the practical value of this discovery, which in point of importance ranks only second with Jenner's discovery of vaccination, has been proved by the complete eradication of this scourge from Havana. We learn from Surgeon W. C. Gorgas, Chief Sanitary Officer of Havana, that in 1900, though the general sanitary condition had immensely improved, yellow fever was still present, amounting to 1,400 cases with 300 deaths, and he felt discouraged at the little progress made. After Reed demonstrated that the mosquito can be infected only during the first three days of the disease and that there is a period of from twelve to fifteen days when the bite of the stegomya can convey the disease, Dr. Gorgas, in February, 1901, reorganized the sanitary department and turned its attention to the local conditions and their relation to the spread and development of the mosquito. The rain barrels, the family cistern, all breeding the stegomya, the Chinese gardens from which came anopheles, were studied and 150 men were put to work to destroy the breeding places by drainage and the addition of kerosene oil to the stagnant water, and the mosquitoes themselves were killed by fumigation and pyrethrum powder. In January, 1901, the city was free from yellow fever, in July the suburbs received a certain amount of reinfection, but on September 28, 1901, the last case of yellow fever occurred. Since that time the land has been practically free, since Havana has been the center of infection. Dr. Gorgas has shown what organized scientific efforts can accomplish in the eradication of disease germs and their carriers, and it is to be hoped that the present government will maintain the same vigilance and radical precautions. There can be no half-way measures. The sanitary history of Havana is one of the most brilliant chapters in American sanitation and augurs well for the twentieth century. What has the Government done to reward the labors of Reed, Carroll, Agramento and Lazear? or for that brave young soldier Kissinger, from Ohio, who, on December 5, 1900, was the first to volunteer to be bitten by infected mosquitoes, with the only proviso that he should receive no pecuniary reward, but as he expressed it 'solely in the interest of humanity and the cause of science.' Such exhibition of moral courage as well expressed by Doctor Reed has never been surpassed in the annals of the Army of the United States, and, we will add, could never have been inspired except by a man of Dr. Reed's stamp.

Part II. of Professor Sedgwick's work deals with infection and contagion, their dissemination and control and fundamental problems of public sanitation, and contains ten chapters. His selections on man and other animals and their excreta, as sources and prime movers of infection, on dirt and disease and the philosophy of cleanness are presented in an original and effective manner, as are also

chapters on sewage and water supplies and ice. He very properly emphasizes the important services rendered by the State Board of Health of Massachusetts in solving some of the problems involved in the purification of sewage by land treatment or intermittent filtration, and the purification of water by slow sand filtration. His description of the latter process is very simple and clear, and while the process is nearly, if not exactly, the same as in the purifying of surface waters which pass through earth and become ground waters, we believe that properly constructed filter beds are an improvement on nature as there will be no geological flaws which permit the passage of disease germs. We cannot subscribe entirely to the author's views expressed on p. 239, regarding artificial processes of purification of water supplies, especially the process known in America as mechanical filtration, and especially his paragraph on page 240 relating to the hygienic efficiency of rapid mechanical filters. The importance of the subject demands a full presentation of the comparative efficiency of the natural, or slow, and the rapid mechanical filters. Perhaps the most recent and exhaustive discussion of this subject will be found in Senate Document 1901, 'Purification of Washington water supply,' edited and compiled by Charles Moore, Clerk of the Senate Committee on the District of Columbia. On page 195, a Committee of the Medical Society states that the most important aspect from which the two methods of filtration shall be compared is in their relation to public health and more particularly in relation to what they have accomplished in the reduction of typhoid fever mortality in cities where they have been employed. Viewed from this standpoint, it appears that the mechanical filters, as first pointed out by Mr. Hill, have accomplished relatively very little in the reduction of typhoid fever death rates. In a subjoined table five American cities using the mechanical devices are compared with five cities in Europe using water from sand filters, with an average for the year 1895 for the American cities of 46.8 typhoid fever deaths per 100,000 of the population against 6 deaths per 100,000 for the foreign cities; that is to say, the American rate was almost eight times as great as the foreign rate. Lest this comparison between foreign and domestic cities be considered unfair, another table was presented showing the average number of deaths from typhoid fever in several American cities before and after filtration. This table shows that while sand filters accomplish a reduction of 78.5 per cent. in the number of deaths from typhoid fever, the establishment and use of mechanical filters have coincided with an increase of 20.43 per cent., and even if the statistics from Elmira, Lexington and Newcastle, where an increase was noted, are eliminated, the reduction of typhoid fever in consequence of mechanical filtration amounts to only 26 per cent., as compared with 78.5 by the process of slow sand filtration. We believe that even the more recent experiments at Pittsburgh quoted by Sedgwick and Mason as indicative of hygienic efficiency of the mechanical filters, show the inferiority of this system as compared with the sand filter.

EXPERIENCE OF SIX MONTHS AT PITTSBURGH, PA.

	Bacteria in Raw Water per Cubic Centimeter.	Percentage of Bacteria Removed.	Number of Bacteria per Cubic Centimeter of Effluent.
Jewell filter.....	11,531	97.45	294
Warren filter.....	11,531	98.26	200
Sand filter.....	11,531	99.09	105

If typhoid germs are proportioned to the colonies of bacteria found in the effluent of a filter, can any one deny that the prevalence of typhoid fever among the users of each of the three waters as deduced from the above figures would be in the proportions of 105, 200 and 294, or nearly 1, 2 and 3, the advantage being in favor of slow sand filtration? From the testimony at hand there appears to be no doubt that sand filtration has given better results than mechanical filtration; the former has been in use since 1839, and is an imitation of nature, whose processes are generally simplicity and perfection, while the latter requires mechanical devices and is still an experiment from the hygienic standpoint, that is, as bearing on the prevalence of ty-

phoid fever, and requires, moreover, the addition of alum. It is the alum, not the filtration, which is actively concerned in the removal of the bacteria. If enough alum is added the effluent is clear and gives satisfactory results on bacteriological examination. If an insufficient quantity is added the effluent may be turbid and charged with bacteria. If too much is added or more than can be decomposed by the carbonates present, alum will remain in solution in the effluent as a most undesirable accidental constituent; and finally, the life of an English sand filter is practically unlimited, while that of the mechanical type is as yet undetermined. In view of all these facts, the writer finds no difficulty in unhesitatingly declaring in favor of the natural method of sand filtration, especially as the superiority of this method in the suppression of typhoid fever may be accepted as acknowledged even by the advocates of the mechanical process.

Professor Sedgwick's chapter on ice as a vehicle of infectious disease, the ice supply and the public health, on p. 251, is especially interesting; the more important facts are summarized as follows: "(1) While it is true that some individual bacteria survive exposure to freezing and even very low temperatures, such conditions are highly unfavorable to bacteria in general, even of the same kind, especially if the exposure be prolonged. Water does certainly tend to purify itself, and under ordinary and favorable circumstances does actually and extensively purify itself during freezing. On the other hand, such purification, while great, is usually incomplete. (2) Out of a number of individual bacteria of any kind subjected to freezing, a large proportion usually perish, especially if they continue to be exposed to the low temperature for two or three weeks, but a small proportion survive. (3) There is good reason to believe that the efficiency of the survivors and their virulence are weakened both by their loss of numbers and by freezing or by long exposure to low temperatures. These facts taken together with those already mentioned above enable us to explain all or nearly all the phenomena in question. They also enable us to draw important conclusions concerning the dangers of the pollution of ice and concerning ice supply and the public health."

In the next paragraph he says: "Although from what has now been said it is clear that there is much truth in the popular opinion that water purifies itself in freezing; it is equally plain that too much reliance must not be placed upon this process. Ice should be made only from good raw materials, *i. e.*, from waters which are pure and potable, and this is doubly true if 'artificial' rather than 'natural' ice is to be used for public or private supplies." In view of these difficulties the writer has urged upon his students for years the dangers of mingling of melted or cracked ice with food and drink, for apart from the possibility of infected ice he is convinced that many of the digestive derangements so common in this country are induced by the low temperatures of food and drink. A temperature of between 50° and 60° F. is sufficiently low to be refreshing, and for this purpose he recommends that the bottles containing the filtered or boiled water and other articles of food be set on ice or placed in a cold storage."

Chapter XI., on milk as a vehicle of infectious disease, is also extremely valuable and must be read to be thoroughly appreciated. The importance of this article of food in relation to public health has been thoroughly studied; the present writer continued the investigations made by Mr. Ernest Hart in 1881 and presented his conclusions, based upon the tabulated histories of 330 outbreaks of infectious diseases spread through the milk supply, before the International Medical Congress at Paris in 1900; these outbreaks consist of 195 epidemics of typhoid fever, 99 epidemics of scarlet fever and 36 epidemics of diphtheria. On page 284 the author says: "One of the most startling discoveries recently made in regard to infectious materials in milk is that of Dr. Stokes and an associate, of Baltimore, who investigated a curious creamy yellowish layer of a slightly suspicious appearance upon milk derived from a dairy tributary to that city. They found that the yellow layer was largely composed of pus and finally traced its origin to a herd affected

with garget." The writer in his article on morbific and infectious milk, Report of Health Officer of the District of Columbia, 1895, referred to Professor Brown's observation published in the *Transactions* of the Epidem. Society of London, Vol. VIII., 1888–1889, p. 34, who, in speaking of a communicable udder disease of the cow, said: "Whatever the disease really might be, it was at least certain that the milk of cows suffering from it was contaminated with pus and other morbid products which might very well be responsible for human disease. * * * The condition of the milk can be judged best from the remark of a dairy boy, who said: 'They could not drink the milk themselves and had sent it to London, but they hoped the poor people there would not suffer.'" Indeed, D. J. Fagan described, in the *British Medical Journal,* Vol. II., 1869, p. 489, a case of pseudo-membranous stomatitis produced by the milk of a cow with inflamed udder, and after, Guillebeau, Adametz, Mace and Hueppe found several pus-producing organisms in the milk of cows suffering from garget, the writer in the paper already referred to felt warranted in declaring that in all the epidemics of scarlet fever and diphtheria which were traced to milk from cows suffering with some inflammatory lesions of the udder, we have typical instances of a streptococcus and staphylococcus infection, and Grey Edwards, in August, 1897, published cases of follicular tonsilitis in which these organisms were not only found in the suspected milk and in the milk of a certain animal, but also in the culture from the throat. We quite agree with the author that the outlook for improved milk supplies, in consequence of wholesome agitation and public demand, is very encouraging.

Chapter XII. on certain uncooked foods, meats, oysters, fruits, vegetables, etc., as vehicles of infectious disease and the sanitary significance of cooking is likewise of great importance, as are the chapters on the prevention and inhibition of infection and disinfection, and disinfectants.

Part III. deals with some popular beliefs as to certain special and peculiar causes of disease, and 'dwells briefly upon some of the more widespread of the fallacious notions or half-truths of sanitary science, and defines explicitly the present attitude of the best opinions of the time in regard to certain subjects relating to the public health commonly misunderstood or misinterpreted.' Among the topics discussed are the belief in dangers from sewer gas, which he regards as very much exaggerated, though he freely grants the possible efficiency of sewer gas as a general poison and depressant. The writer, however, disapproves of the presentation of the subject matter in relation to wells, even at the risk of being classed among the pseudo-sanitarians; he feels disposed to regard most wells with grave suspicion, for the simple reason that family wells and privies are, alas, too often dangerous neighbors. This comparatively novel point of view has been forced upon us by the numerous outbreaks of typhoid fever spread through polluted wells. We also know that typhoid fever is far more common in the country than in cities, and as a result of a general introduction of a common supply in the country towns of Massachusetts in place of that derived from individual wells, a very decided decline in typhoid fever has been noticed.

Again, the typhoid fever death rate at Munich at a time when that city was riddled with cesspools and wells, was 210 per 100,000 of population; with the introduction of sewers and a pure water supply, the rate has fallen to 3 per 100,000.

Professor Sedgwick evidently has the utmost confidence in the filtering powers of the earth, and deems it very unlikely that disease germs survive in or pass even a few feet through soil beyond a leaky cesspool. We fully agree with him that the dangers of infection from the top of the well have not been sufficiently emphasized; on the other hand, Drs. Abba, Orlandi and Rondelli, who experimented on the filtration capacity of the soil about the filter galleries of the Turin water supply, found that cultures of *Micrococcus prodigiosus* poured with large volumes of liquid into the ground at various points made their appearance 200 meters away in 42

hours, and 27.5 meters away in 7 hours;* showing what we started out to say, that the soil cannot be depended upon to hold back all the organisms from wells, and certainly not when in dangerous proximity to barnyards and privies; moreover, the above typhoid fever statistics appear to fully warrant this conclusion. As regards the belief in dangers from damp cellars, the writer is of the opinion that this fear on the part of the more intelligent of the human race is well founded. Damp cellars usually mean damp walls and dampness of the air of the house; this not only leads to undue abstraction of animal heat and lowers the vitality of the inmates, but also influences the cutaneous functions and favors the development of catarrhal and rheumatic affections, and a bronchial catarrh thus produced renders the mucosa vulnerable to the invasion of tubercle bacillus. This would appear to explain the undue prevalence of consumption in some of the damp prisons, the relation between dampness of soils and consumption, as first pointed out by Bowditch and Buchanan, and the good effects of drainage in the reduction of consumption. In spite of these differences of opinion, we predict that Professor Sedgwick's hope that his book may find a useful place in sanitary education, both professional and popular, will be fully realized.

Professor Mason's book on 'Water Supply' has reached the third edition since 1896, and is well and favorably known. The book is divided into eleven chapters, dealing with the history of water supplies, drinking water and disease, artificial purification of water, natural purification of water, rain, ice and snow, river and stream water, stored water, ground water, deep-seated water, quantity of per capita daily supply, action of water upon metals. The appendix deals with analysis of city water supplies, typhoid fever death rates for American and European cities, effects of contaminated water upon fish, use of sea water for street washing, sewer flushing, etc. It is an excellent work from a sanitary standpoint, and will continue to enjoy its present popularity. The chapters on the 'chemical and bacteriological examination of water' have been omitted from the present edition, as they have been published in a separate book for the more convenient use of students.

Professor Horrock's book, an introduction to the bacteriological examination of water, will be a welcome addition to the working library of the sanitarian. While assuming a knowledge of elementary bacteriology, the author in Chapter I. gives directions for the collection of samples, followed in Chapter II. by the method pursued in qualitative bacteriological analyses and the preparation of water plates. The next chapter deals with multiplication of the water microorganisms, the influence of light, rest and movement, sedimentation, chemical conditions upon the duration of bacterial life, and the action of electricity on bacteria. Chapter IV. considers the bacterial contents of snow, ice, hail and rain, and of waters from rivers, lakes, wells and springs. We quite agree with him and Mace that the number of microorganisms present does not give any accurate information as to the value of a water, for it is after all the character of the germs which concerns us most, at the same time Mace suggests the following classification, based upon a long series of examinations:

	Microorganisms per c.c.	
Very good water contains from	0–	50
Good " " "	50–	500
Mediocre " " "	500–	3,000
Bad " " "	3,000–	10,000
Very bad " " "	10,000–	100,000

Chapter V. contains a very satisfactory presentation of the action of sand filters in the elimination of bacteria, which he considers, like most authors, as partly mechanical and partly vital.

Chapters VI. to XV. are devoted to the qualitative bacteriological analyses of water and constitute the most valuable part of the book to the student. Chapter XV. describes the mode of action and utility of the Pasteur, Chamberland and Berkefeld filters and the methods of testing water filters, and the final chapter gives a summary of the procedure recommended for the bacteriological examination of water and preparation of nutrient media.

* *Zeitschrift f. Hyg.*, Vol. XX., p. 66; see also Professor Pfuhl's experiments in the same journal for 1897, p. 549.

Mr. Baker's book on 'Municipal Engineering and Sanitation' is one of the series of the Citizen's Library published by the Macmillan Company, and is 'intended for that large and rapidly growing class of persons who, either as officials or as citizens, are striving to improve municipal conditions.' For this purpose the book cannot be too highly recommended, and if generally read cannot fail to exercise a powerful influence for good in sanitation, as it will stimulate an interest and educate the public in the various and important questions of municipal hygiene. The book is divided into five parts with 43 chapters. Part I. deals with the city and its needs, ways and means of communication, including streets, pavements and sidewalks, subways, grade crossings, urban and interurban transportation, bridges, docks, telegraph, telephone and messenger service.

Part II. treats of water supplies, water purification, water consumption and waste, pure ice, milk, markets and slaughter houses, municipal office buildings, light, heat and power. Part III. contains chapters on sewerage and drainage, sewage disposal, street cleaning, collection and disposal of refuse, cemeteries and crematories.

We like the text and the whole tone of the book; here is a sample: "One reason for the unsatisfactory state of garbage disposal in the United States is the failure to recognize that the problem is a technical one, demanding a high grade of engineering knowledge for its solution. Most cities intrust the study of the garbage question to some council or committee possessed with no previous knowledge of the subject and with no training which fits its members to gather and weigh information. Such committees generally take a more or less extended tour of inspection of garbage plants in other cities, where they are very likely to be met by commercial agents of the various systems in use; the outcome often is that the agent who can make the most favorable impression on the committee, by talk, wine and theaters, has the pleasure and possible profit of having his system adopted. Rightly conducted these trips may prove instructive and valuable, but, hurried and superficial as they usually are, they are likely to give false impressions. They should always be supplemented by competent engineering advice. The latter might be obtained in the first instance with less expense and more certainty of sound conclusions than is likely to be the result of an investigating trip by three to ten laymen."

Part IV. deals with protection of life, health and property, and contains chapters on fire protection, building and plumbing regulations, electrolysis of underground pipes, smoke abatement, suppression of noises, disinfection, prevention of water pollution, public baths and wash houses, public lavatories and water-closets, municipal dwellings and lodging houses, municipal parks, playgrounds and gymnasiums. These chapters are of special interest to the general reader. We are told by the author that the cities of Europe and Japan are far in advance of American municipalities in the provision which they have made for public baths. The city of Tokio is said to contain one thousand such establishments.

In the United States at the close of 1900 not more than a dozen cities had provided themselves with all-the-year-round baths. It is sometimes urged that in this country there is much less need of public baths than abroad on account of the greater prevalence of bath rooms in private homes, and in connection with philanthropic organizations, but the fallacy of this argument is apparent by the statistics collected by the United States Department of Labor, which show the percentages of the families in four of our largest cities who had no bath rooms, Baltimore 98 per cent., Chicago 97 per cent., New York 97 per cent., Philadelphia, 83 per cent. A similar plea is made for public lavatories and water-closets, which are lamentably deficient in American cities, and often compel recourse to saloons. The chapter on municipal dwellings and lodging houses contains food for reflection. The author says: "An exhibit in the year 1900 by the Tenement House Committee of the New York Charity Organization Society made apparent the fact that there is no place in the world where the decent poor have so poor a chance to live decently as in New York.

Other American cities are also afflicted with overcrowding. More yet are cursed with dwellings that are unsanitary in other respects. It is well known that the death rate in all such buildings, poorly ventilated, with deficient water supply and defective plumbing, is abnormally high. The death rate is but a partial index of the harm done by overcrowding, for the results are moral as well as physical and there is no death like the death of virtue. Where large fractions of the population are packed together under such conditions that personal cleanliness, modesty and decency, and even sexual morality, are practically impossible, the problem is one whose speedy solution demands the attention of the moralist and the philanthropist, as well as the sanitarian." The author makes a strong plea for model tenements at reasonable rentals, and Chapter XXXII. sets forth the necessities and advantages of municipal parks, playgrounds and gymnasiums, all of which will find a sympathetic response in the hearts and minds of those who have the welfare of the human race at heart. Part V. deals with administration, finance and public policy, including city charters, municipal experts, the department of public works, the work of the board of health, municipal franchises, ownership and expansion and many kindred subjects.

Dr. Rideal's first edition on sewage and the bacteriological purification of sewage appeared in May, 1900, and enjoyed such a rapid sale in England and America that a second edition was called for in June, 1901. The work is divided into twelve chapters, and is of intense interest to the engineer and sanitarian. The introductory chapter deals with the characters of sewage and primary methods of disposal, committal to earth, cremation, cesspools, sewers, scavenging, conservancy systems, infiltration, official regulations, water-closet system, dilution in rivers, tidal discharge. In this chapter will be found a historical résumé of the subject of sewage disposal. In speaking of the location of privies and middens, he refers to the danger of wells, springs and rivers from infiltration and points out a number of cases where such pollution took place; in one instance the contaminating influence was about a half a mile distant. He also refers to the reports of the medical officers of health in 1900, notably those of York and Durham, who give statistics showing the connection between outbreaks of typhoid fever and midden privies. He quotes from an address by Sir William Preece before the National Health Society, October, 1899, wherein he referred to the city of Leeds, with a population of 400,000, with a reduction during the twenty years 1875 to 1895 in the death rate from 28 to 18 per 1,000 in consequence of the completion of sewers and the introduction of a better water supply, and continued, 'if this has been accomplished in one city by acting on those principles of applied science, what might be the total number of lives saved throughout the country by the operation of those whose duty it was to carry out the details of the science of sanitation?' The same question may very justly be applied to our own country when we consider that only about 30 per cent. of the population live in sewered towns and 41 per cent. live in towns having public water supplies. During the census year of 1900, there were 35,379 deaths from typhoid fever, which means an annual prevalence of 350,000 cases and a loss to the commonwealth of $185,000,000 per annum from one of the so-called preventable diseases. The undue prevalence of typhoid fever in unsewered towns and suburbs has already been pointed out and explained by the writer in a former review in Science, November 8, 1901. Chapters 2 and 3 deal with the chemical analyses of sewage and effluents. Chapter 4 with the bacteria in sewage and possibility of the survival of pathogenic organisms. Chapter 5 points out the chemical changes produced by bacteria. Chapter 6 discusses the ultimate disposal of sewage and treats very fully of irrigation and sewage farms. The treatment of sewage by subsidence and chemical precipitation, by heat, chemicals and electricity is disposed of in Chapters 7 and 8. The next three chapters, which are the most important in the book, deal with bacterial purification in a most exact and painstaking manner. On the whole we may conclude that sewage farming will have a very promising future in the West, where

every drop of water is needed for general irrigation. In sections of our country not adapted to farming and where land is scarce, the purification of sewage by intermittent filtration, which requires only about one twentieth the land, has been resorted to, and we are indebted to the splendid experiments made by the Massachusetts State Board of Health, at Lawrence, for much valuable information concerning the efficiency of this system, and which indeed has been adopted by a large number of municipalities both at home and abroad. In communities where land is so scarce that even intermittent filtration is impracticable, a number of processes for the purification of sewage before its discharge into the rivers have been proposed, such as chemical precipitation, sterilization, sedimentation, etc. These processes, however, are now considered as wrong in principle and aiming at the unattainable, and wherever irrigation or intermittent filtration cannot be advantageously carried out, preference should be given to the 'septic or bacterial tank.' This system was devised by Mr. Cameron, of Exeter, England, and is really an elaboration of the old cesspool; the tanks are built of concrete, brick or masonry walls, tightly covered to exclude both light and air, and large enough to contain the flow of sewage from 1,500 to 2,000 persons for from twelve to twenty-four hours. The raw sewage without screening or any preliminary treatment enters by two inlets which are carried down five feet below the surface in order that the entry may be quiet, so as not to disturb the bacterial layers, also that air may not be carried in or any gases escape back to the sewer. After passing through a 'grit chamber' 10 feet deep by 7 feet long and 18 feet wide, the sewage flows over a wall submerged one foot below the surface into the main portion of the tank, which is 65 feet in length, 7 feet 6 inches in depth and 18 feet wide, its capacity being 53,800 gallons, or approximately a day's supply; hence the transit of the sewage is ordinarily very gradual, averaging about 24 hours in the tank, so as to give ample time and quiet for the putrefactive changes which are brought about by the anaerobic bacteria, and which result in the digestion of the suspended organic matter, or its conversion into simpler, soluble forms and gases. The effluent from the tank, brownish-yellow in color and offensive in odor, after being aerated by being run over a weir and cascade arrangement, is next passed over the 'Dibdin bacteria beds' filled with coke breeze and clinkers, where the nitrifying organisms perform their share of the work, until the filtrate is fit to be discharged into the water courses, although whenever practicable it should be previously passed through well-drained land or over water meadows.

The advantage of the tank lies in the reduction in the amount of suspended matter; the accumulation of sludge from the sewage and excreta of 1,500 persons amounted to but four feet at the end of three years' trial; the operating expenses are also very slight and so far the bacterial or septic tank has given the most satisfactory results from a sanitary and economic standpoint, where broad irrigation or sewage farming cannot be applied. Chapter 12 deals with the agricultural value of bacterial effluents and conservation of the valuable constituents of sewage, the classification of trade effluents and the recovery of waste products.

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SCIENTIFIC JOURNALS AND ARTICLES.

THE third (July) number of Volume 3 of the *Transactions of the American Mathematical Society* contains the following papers: 'On the Group defined for any given Field by the Multiplication Table of any given Finite Group,' by L. E. Dickson; "Nachtrag zum Artikel: 'Zur Erklärung der Bogenlänge, u. s. w.,'" by O. Stolz; 'Proof of the Sufficiency of Jacobi's Condition for a Permanent Sign of the Second Variation in the so-called Isoperimetric Problems,' by O. Bolza; 'On Hypercomplex Number Systems,' by H. E. Hawkes; 'On Metabelian Groups,' by W. B. Fite; 'Conjugate Rectilinear Congruences,' by L. P. Eisenhart; 'Constructive Theory of the Unicursal Cubic by Synthetic Methods,' by D. N. Lehmer; 'The Groups of Steiner in Problems of Contact (second paper),' by L. E. Dickson.